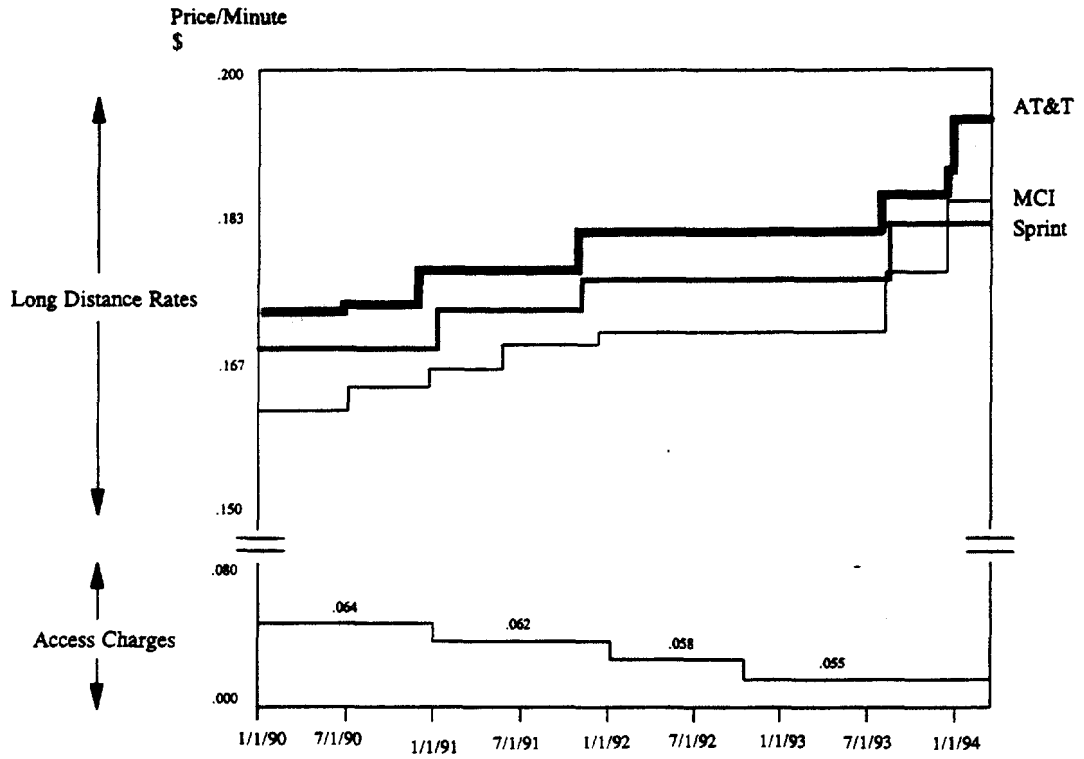
The analogy between square miles of concrete and copper or glass wires or Class 5 telephone switches just doesn't work. Finding six square miles of virgin land on which to pour concrete is very much more difficult than stringing new wires along existing telephone poles or through city-owned conduits. No technology on the near horizon is about to turn a bus into an airplane, but digital and fiber-optic technology assuredly is rapidly turning cable television into telephone, and vice versa. The switch between land and air -- between copper and wireless -- is manifestly happening in telephony today; both AT&T and MCI are betting billions on it. There is nothing remotely comparable happening in aviation. In the last decade, 14 million customers have bought wireless phones; the aviation equivalent would be 14 million former flyers traveling on Amtrak -- which has not happened. United Airlines is not required to give equal access on its planes to American, nor is the owner of a private airport required to serve all comers. But equal access is the solidly established standard in common carrier telephony.

So far as the airline analogy teaches any lessons at all, the lessons are not ones that AT&T and MCI would want to promote. Without doubt, the large, powerful airline carriers are the "long-distance" companies of aviation. The most competitive part of the airline industry is the short-haul sector. Trains, buses and cars *do* compete with planes over short routes. Small, local airports are much more numerous than big ones. Nobody is suing the upstart regional airlines, nor even owners of private airports, for monopolizing anything at all in aviation. The big long-distance carriers, by contrast, have repeatedly been charged with anti-competitive practices, particularly in connection with their lock-step pricing. There is perhaps some analogy worth pursuing here after all. **FIGURE 20.**

Figure 20. Trends in Long Distance Rates and Exchange Access Charges[386]



[386]Source: WEFA Group, Economic Impact of Eliminating The Line-of Business Restrictions on the Bell Companies (July 1993); Robin Gareiss, *Rate Hikes: MCI, Spring Follow AT&T's Lead*, COMMUNICATIONSWEEK, Aug. 9, 1993, at 60; Dan Reingold, MERRILL LYNCH GLOBAL SECURITIES RESEARCH, LD INDUSTRY BENEFITS FROM AT&T PRICE HIKE, AGAIN, Jan. 25, 1994: Eric Paulak, AT&T, MCI Jack Up Rates Again, Network World, Jan. 24, 1994, at 37. With the exception of the most recent rate increase, long distance rates are based on the average price per minute for basic service. For the most recent rate increase, MCI and Sprint rates are estimated as the average of their stated range of rate increases. AT&T rates are estimated as the average of its proposed business rate increase and its smaller proposed residential rate increase--a conservative estimate, considering that more revenue comes from business customers than from residential customers.

VII. WHERE ARE AT&T AND MCI PUTTING THEIR MONEY?

AT&T and MCI understand the difference between fact and theory well enough. They are investing billions of dollars in markets that -- according to the Report -- are bound to be dominated and subverted by the BOCs forever.

AT&T recently agreed to spend $17.5 billion to acquire McCaw -- a company that competes directly with BOC cellular subsidiaries. Interestingly, the AT&T/MCI Report contains no mention of this new foray by AT&T into local exchange service. Cellular companies like McCaw require essentially the same local exchange interconnections as long-distance carriers. They are at least as vulnerable to cross-subsidy, probably more so, because they operate right in the heart of the local exchange. But, on November 5, 1993, AT&T decided to pay top dollar to get into the market.

MCI contradicts its advocacy with its bankroll every bit as loudly. As discussed above, MCI recently announced plans to compete directly against BOCs in providing local exchange service. On January 4, 1994, MCI unveiled a $2 billion plan to develop alternative local transport network architecture.[387] Most recently, MCI announced plans to spend $1.3 billion to buy 17 percent of Nextel, which is developing local digital wireless service.[388] These developments, too, are not mentioned in the AT&T/MCI Report. But they speak far more loudly than any grand theory of local telco hegemony.

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[387]Martin Dickson, *MCI Puts Dollars 2bn into Local Challenge*, FINANCIAL TIMES, Jan. 5, 1994, at 15; *MCI Unveils Long-Range Vision: Network MCI; Opens Nation's First Transcontinental Information Superhighway; Announces $20 Billion in Strategic Initiatives*, BUSINESS WIRE, Jan. 4, 1994.

[388]*Cable Deal is Possibility; MCI Goes for "Now" Wireless Technology for Nationwide Network*, COMMUNICATIONS DAILY, Mar. 1, 1994, at 1.

VIII. A NETWORK OF NETWORKS

The authors of the AT&T/MCI Report boldly reject the now widely accepted view of where telecommunications is headed. The Report concludes that the industry is *not*, after all, evolving into a "network of networks." It will *not* be a highly interconnected matrix of wireless, satellite, copper, coaxial and glass, with many providers and no single dominant center. The telephone network is a thing apart, and "fundamentally hierarchial."[389] Local telephony will continue to dominate everything. This "geocentric" network[390] follows inevitably from the economic law of natural monopoly -- a law apparently as immutable as Ptolemaic astronomy.

And as accurate, too. As discussed above, the first and most obvious problem with the geocentric model is that there are eight planets, not one. If Bell Atlantic (say) is the center of the universe around which AT&T and MCI must revolve, where exactly does that leave Southwestern Bell -- which happens to own cable interests in Bell Atlantic's territory in Virginia, as well as telephone facilities on its home turf in Texas? The trouble with any kind of "centric" model today is that most telecommunications markets are national. One cannot speak coherently about nine "centers" to a national market any more than about nine bottles-necks.

The AT&T/MCI Report aside, almost nobody else tries to. Indeed, the vision of the *geodesic* network, or something much like it, is now almost universally accepted. The Clinton Administration's commitment to promote development of the National Information Infrastructure is based on "a seamless web of communications networks, computers, databases, and consumer electronics."[391] Dr. Mike Nelson, Special Assistant for Information Technology in the White House Office of Science and Technology Policy, sees phone and cable companies as "primary players" in developing what he calls the NII's "network of networks," but notes opportunities to participate will also present themselves to other communications and information technology vendors.[392] Tom Kalil, Director of Science and Technology for the National Economic Council, explains: "[p]eople assume we are automatically talking about wires, but they don't realize that we're also talking about wireless and broadcast satellites * * * that's why the phrase 'a network of networks' is so

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[389]AT&T/MCI REPORT at figure 2.11 (emphasis omitted).

[390]"Geocentric adj.1. having or representing the earth as a center: a geocentric theory of the universe. 2. using the earth or earthly life as the only basis of evaluation. 3. viewed or measured as from the center of the earth: the geocentric position of the moon." Random House Unabridged Dictionary, (2d ed., 1993).

[391]THE NATIONAL INFORMATION INFRASTRUCTURE: AGENDA FOR ACTION, Sept. 1993, at Executive Summary.

[392]*NII Board to Include Members of Satellite Industry; Advisory Committee on the National Information Infrastructure*, DEFENSE DAILY, Dec. 10, 1993, at 47.

important. No one has in mind a monolithic, centrally designed platform for disseminating all the information."[393]

The FCC describes the evolution of the network in much the same terms. We are moving toward "a robust 'network of networks,' in which the switched networks of CAPs and others interconnect with, but also compete with, each others' as well as the LECs' switched access networks."[394] According to FCC Policy and Planning Chief, Robert Pepper, "[i]t's clear there's going to be full-fledged competition in the telecom markets * * * It's going to be wired and wireless; narrowband and broadband; telcos and cable and wireless -- all driving transport down to a commodity service."[395] As former FCC chairman Alfred Sikes testified before Congress: "I do not believe that affording telephone companies expanded opportunities will result in a single network. Rather, I believe there will be satellite, mobile, broadcast, as well as cable and other distribution technologies. They will provide both independent and competitive transmission paths, and will often be linked together in a network of networks."[396]

Independent analysts have reached very similar conclusions. George Calhoun, the author of two major books on radio telephone,[397] asserts that "the abandonment of hierarchical structures is gathering momentum, especially in the core public network and in specialized computer networks."[398] Calhoun proposes his own alternative metaphor for the network. The "laminar network," Calhoun explains, is "a series of partly competing, partly complementary, somewhat differentiated,

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[393]Kim McAvoy and Sean Scully, *Interagency Task Force Expected To Release Report Before End of Summer; National Information Infrastructure*, BROADCASTING & CABLE, July 5, 1993, at 26.

[394]Second Notice of Proposed Rulemaking, In the Matter of Expanded Interconnection with Local Telephone Company Facilities; Amendment of Part 36 of the Commission's Rules and Establishment of a Joint Board, 7 F.C.C. Rcd 7740, 7741 (1993).

[395]Rachel W. Thomson and Jeannine Aversa, *Information Interstate: Life in The Fast Lane; Superhighway Deals Test Regulators; Information Superhighway*, MULTICHANNEL NEWS, June 7, 1993, at 3.

[396]*Communications Competitiveness and Infrastructure Modernization Act of 1991: Hearings on S. 1200 Before the Subcommittee on Communications of the Committee on Commerce, Science and Transportation*, 102d Cong., 2nd Sess. 16 (1992) (Statement of Alfred C. Sikes, Chairman, Federal Communications Commission).

[397]GEORGE CALHOUN, DIGITAL CELLULAR RADIO (1988); GEORGE CALHOUN, WIRELESS ACCESS AND THE LOCAL TELEPHONE NETWORK (1992).

[398]GEORGE CALHOUN, WIRELESS ACCESS AND THE LOCAL TELEPHONE NETWORK 532. "The packet-oriented, switchless local-area network is perhaps the prototype for the geodesic future. And if it holds for local networks, then perhaps it will pertain to larger networks as well. The trade-off between processing power and copper or glass is real, at least for some segments of the network, and some applications." *Ibid.*

overlapping access fabrics" that "will consist of multiple layers of transmission facilities for accessing the core network at an increasing number of gateways. The lowest levels will still be copper-based fabrics, the vast installed base of wireline telephony and coaxial cable TV plant that will continue in use for decades. Growing over these there will be several new layers of fiber optic plant -- and, because of its nature, ever more layers of digital radio. Even within a given fabric layer there will almost certainly be a great deal of technical diversity."[399] FIGURE 21.

One of the most recent independent analyses of the nature of telecommunications networks appeared in the March 1994 issue of *Byte* magazine. On the basis of interviews with nearly 100 industry executives, engineers, analysts, users and policy makers, *Byte* sets forth a careful description of where telecommunications networks are heading.[400] At present, *Byte* explains, phone companies and cable companies use different topologies and technologies to deliver services. The telephone companies' switched, symmetrical and interactive system uses a digital fiber backbone and analog copper wires to deliver services to the end-user. Cable companies operate an unswitched analog network, on fiber and satellite backbones and coaxial cables for a strictly downstream distribution of video signals. But both cable companies and local exchange companies are building networks that will be nearly identical. Interconnected signal collection and routing points will feed services via fiber to the neighborhood or the curb. From these nodes, data will enter homes and businesses on a mix of coaxial cable, copper wire, and fiber to reach set-top boxes, computers, and phones. Both systems will be switched and two-way, linked to data and video servers, though not necessarily symmetrical or entirely digital.[401] FIGURE 22.

The AT&T/MCI Report responds to all this with economic theory. A "network of networks," the Report announces, "in no sense implies a 'network of equal networks.'"[402] But networks don't have to be identical, or exactly equal, to be competitive. By the Report's logic, a market served by 10 firms would not be competitive unless each one served exactly 10 percent of the market. But no serious economist accepts that as true. Competition does not require absolute equality among competitors. All it requires is many competitive boundaries, with plenty of opportunity for one player to capture market share at the margin from the next player.

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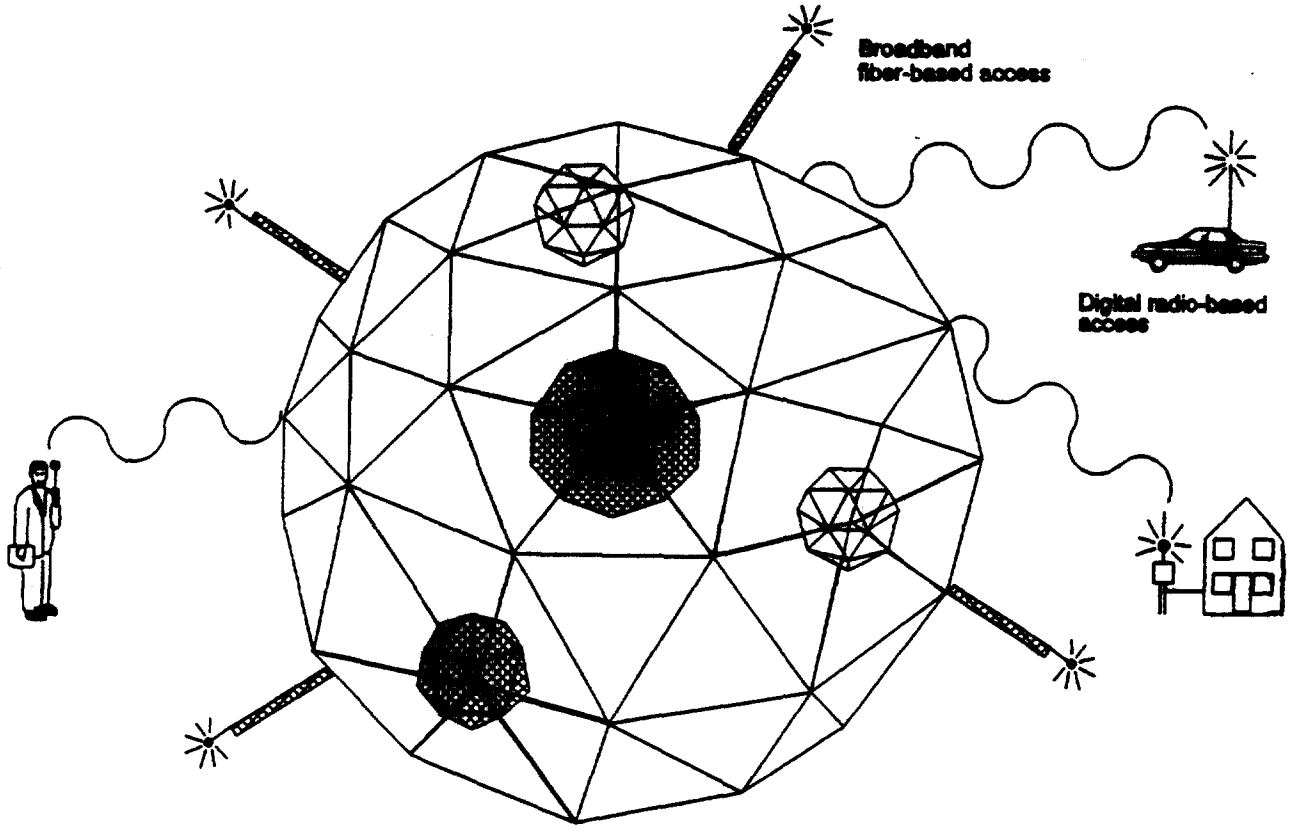
[399] *Id.* at 537, 539.

[400] Andy Reinhardt, *Building the Data Highway*, BYTE, Mar. 1994, at 46.

[401] *Id.* at 48-49.

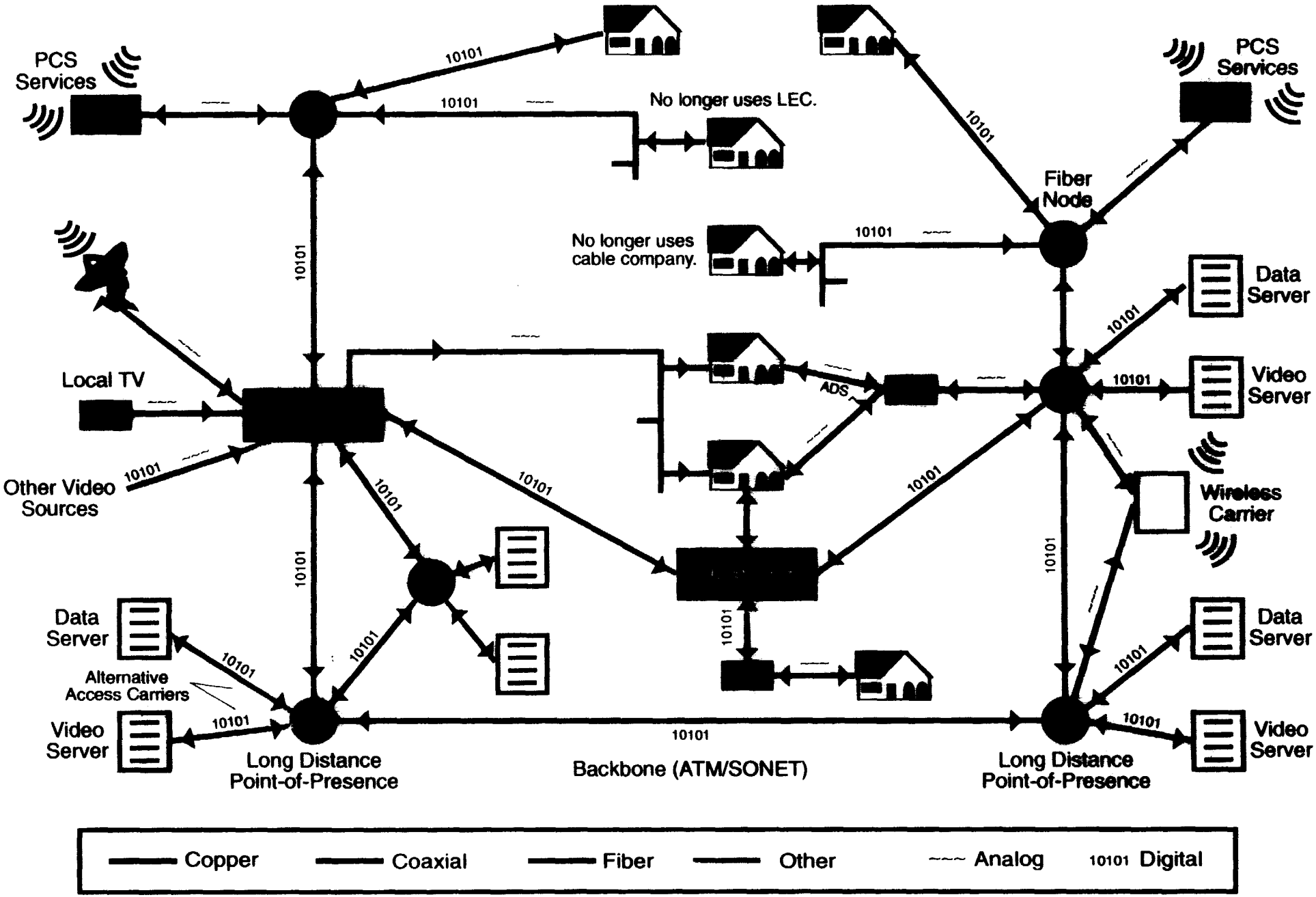
[402] AT&T/MCI REPORT at 55. The Report places this 'network of equal networks' in quotation marks, yet does not give any type of source for it. The Huber Report which the Report is here discussing certainly makes no mention of it, nor does any other commentator the Report mentions.

Figure 21. The Laminar Network[403]



[403]Source: GEORGE CALHOUN, WIRELESS ACCESS AND THE LOCAL TELEPHONE NETWORK 64.

Figure 22
Alternate Network Architecture



Curiously, the AT&T/MCI Report makes a final attempt to rehabilitate its "geocentric" vision by discussing changes in the *long-distance* industry. In the late 1980s, the major interexchange carriers began offering "virtual private line" network services that removed a lot of customers from true private line networks. Those changes, says the Report, are "further shift[ing] the focus of the nation's telecommunications resources away from point-to-point connectivity and toward centralized, hierarchical structures."[404] "[W]hatever geodesic properties these private networks might have indicated [in 1987], those conditions no longer prevail."[405]

Perhaps they do not prevail in the long-distance market. But a decline in competition in long-distance services hardly disproves the rise in competition -- the development of a network of networks -- serving the local market. The 1987 Geodesic Network emphasized just that -- the basic difference between low-density, intermittent traffic in the "last mile" of the network and high-density, steady traffic in inter-exchange trunks.[406] That basic distinction was of course embodied in the divestiture decree itself and supplied the entire rationale for separating "local exchange" from "inter-exchange" traffic.

In a critique of the 1987 Report, however, Dr. Selwyn managed to overlook it entirely. He presented a detailed analysis of the carrying capacities of microwave radio and fiber optic cable, without ever acknowledging that such facilities are never in fact used for low-density, intermittent applications in the "last mile" of the local exchange.[407]

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[404]AT&T/MCI REPORT at 52.

[405]*Id.* at 54.

[406]The Geodesic Network Report declared:

> In the past hundred years, the basic low-density transmission technology -- twisted copper wire routed through underground conduits or via overhead poles --has not changed much, nor has its price. Fiber-optic cable has slashed transmission costs for high-density applications, but the last mile of the network, where about half the transmission expense arises, carries mostly low-density traffic. In the past fifteen years, on the other hand, revolutionary developments in electronics have slashed the costs of switching and other forms of network intelligence. The inexorable trend is therefore to move switching out toward the end user.

PETER HUBER, THE GEODESIC NETWORK: 1987 REPORT ON COMPETITION IN THE TELEPHONE INDUSTRY 1.3.

[407]Lee L. Selwyn and Page Montgomery, Factual Predicates To The MFJ Business Restrictions: A Critical Analysis of the Huber Report at 41-42, *attached to* Comments of the Ad Hoc Telecommunications Users Committee, United States v. Western Elec. Co., No. 82-0192 (D.D.C. Mar. 13, 1987).

The response has already been written by George Calhoun. Criticism of this sort, Calhoun notes, "really duffs it."[408] Wireless, cable and other alternatives are competing against incumbent local telcos precisely because the costs of traditional, copper-based, last-mile connections have *not* by any means fallen as fast as the costs of other technology.[409] That is why CAPs, wireless, and cable ventures, undertaken by AT&T and MCI among many others, are rapidly transforming the network-of-networks imagery into reality.

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[408]GEORGE CALHOUN, WIRELESS ACCESS AND THE LOCAL TELEPHONE NETWORK 80-81 n.39.

[409]The cost per circuit-mile for inter-exchange transmission has fallen dramatically -- by a factor of hundreds -- in the past 50 years. On the other hand, the cost of local exchange transmission (per access line or circuit-mile) has probably not fallen appreciably, if at all, over that time frame. And fiber optics will not change that basic loop cost equation very much. GEORGE CALHOUN, WIRELESS ACCESS AND THE LOCAL TELEPHONE NETWORK 81 n.39.